

Robert Willis's Networks of Knowledge

Alexandrina Buchanan

A key aim of the Symposium 'Robert Willis: Science, Technology and Architecture' was to bring together modern experts in the many different fields to which Willis had made a contribution, both to explore the breadth of his interests and to gain new perspectives on what might have connected his different endeavours. We also wanted to identify the international dimensions of his work: how his ideas influenced and were influenced by those emanating from other countries and identify any links with scholars abroad. Talk of connections and links presents knowledge itself as a network—not simply discrete and isolated ideas and information, techniques and methods, inferences and explanations, but ones which might be shared across different fields and disciplines. In its creation, dissemination and maintenance, knowledge also depends on networks of people—researchers, publishers, educators and readers—who use their relationships for knowledge acquisition, testing and communication. Although none of these proposals is new, the possibilities for identifying and analysing such networks have been significantly improved by digitisation, both in the form of digital materials by which connections may be more easily located and softwares for visualising and interrogating the connections found. This essay will employ a mixture of digital and traditional methods to explore the human networks with which Willis can be associated, in order to try to understand the nature of his participation and as context for his contributions and influence to be discussed by other authors. This has value not merely for reaching a better understanding of Willis as an individual, for as this symposium demonstrates, Willis's polymathic range made him a potential bridge between different fields, at a time when it was still possi-

ble to believe that all forms of knowledge were inter-related and mutually supportive but when, in practice, disciplinary and professional specialisation was reducing the capacity for any individual to participate equally in all fields and the findings of science were increasingly challenging orthodoxies, those of religion in particular. Focussing on one individual also helps to explore both the potential and the challenges of network analysis in a historical context. As networks may seem to have replaced on the one hand individual genius and on the other class and economics as explanatory models, an individual focus can also remind us of the limitations and contingency of networks for historical explanation.

Networks

Relational sociology, the field from which social network analysis proceeds, emphasises the importance of social networks to all human endeavours, including movements, scenes and worlds; nevertheless, the nature of such networks is historically specific. It has been argued that from the late eighteenth-century, as towns expanded and population mobility increased, associational activity started to replace the extended family, neighbours and the Church as structures of support and sociability (Clark 2000). As Paul Elliott puts it, “Collectivism combated the social fragmentation, social mistrust, alienation and isolating tendencies of urban life” (Elliott 2003, 365). These local associations with a broadly Enlightenment remit were supplemented in the nineteenth century by increasing numbers of bodies, both national and local, which were both more narrowly specialist (special interest societies and professional bodies) and more specifically sociable (gentlemen’s clubs).

The significance of networks to Willis and his peers has already been identified, with widespread discussion of the so-called ‘Cambridge Network’, the grouping of scientists associated first with the Cambridge Analytical Society founded by Charles Babbage, then with the Cambridge Philosophical Society founded by William Farish and others, and which eventually came to dominate both the British Association for the Advancement of Science and most of the nation’s public positions in science. Other contemporary networks with which he has been associated include the Cambridge Camden, later Ecclesiological Society, and the Archaeological Institute. All of these can be identified as networks of knowledge —their objective was to create and shape particular forms of scholarly endeavour for public benefit. As Lubenow has observed, in the nineteenth century, learned societies, rather than universities were the key sites for intellectual innovation (Lubenow 2015, 27).

There is nevertheless a vast gap between recognising the necessity of networks and being able to reconstruct them in their historical specificity, and a fur-

ther gap between knowing what networks existed and understanding how any individual within the network used its links for personal advantage. Nineteenth-century networks have previously been studied anecdotally in terms of the social connections—the ties of friendship or cooperation between their members, or administratively—the formal associations by which informal connections were made public and institutionalised, or prosopographically—through genealogical links or exogenous characteristics of the groups, including the gender, educational background, religious and political affiliations of the members. It is also necessary to recognise that although humans are social beings, networks—particularly formal associations—take effort to set up and maintain, which normally falls to key individuals. Ties within networks are constructed, managed and maintained by means of the cultural work involved in discursive practice (McLean 2007, xi). Others participate to a greater or lesser degree and the extent or nature of participation—whether competitive, combative or cooperative—may not directly correlate to the extent of their social, cultural or intellectual capital. “It is not just networks or memberships that matter, but also how these relationships are represented, activated or suppressed in social settings” (Mische 2003, 258). Undertaking systematic study of how individuals made, used and were used by their networks helps us to understand the social webs through which economic, social, cultural and intellectual power could flow, by whom it was brokered and how it might have been impeded.

Societies

In discussing Willis's networking activity, the first aspect to consider is his participation in formal associations, the clubs and societies so essential to nineteenth-century knowledge construction and dissemination. Willis was not a serial joiner of societies and the list of those to which he belonged is as notable for the absences as for the inclusions. He never became a Fellow of the Society of Antiquaries, nor did he join any local antiquarian societies, other than the Cambridge Antiquarian Society, of which he was a founder. He served on committees of the Royal Society of Arts but did not become a Fellow. Despite an interest in language he did not join the Philological Society, set up by Edwin Guest (fellow Cayan and member of the Archaeological Institute), of which his friends William Whewell and Albert Way were founder members. Nor was he a Freemason. The list of bodies to which he is currently known to have retained a long-term association is as follows: the Archaeological Institute (A.I., formerly the British Archaeological Association, B.A.A.); the Athenaeum; the British Association for the Advancement of Science (B.A.A.S.); the Cambridge Antiquarian Society; the Cambridge Philosophical Society; the Geological Society; the Institution of Civil

Engineers; the Honourable Society of Gray's Inn; the Royal Society and the Royal Institute of British Architects. All of these are specifically learned or professional rather than primarily social bodies. At the time of his joining, membership of the Athenaeum was a marker of intellectual distinction: the Marquis of Northampton (member of the B.A.A.S. and later President of the Royal Society and the A.I.) was one of the five trustees and fellow members included many of his circle of friends and collaborators, including Charles Barry, George Basevi, C. R. Cockerell, George Peacock, Albert Way, William Whewell and most of his contacts within the Royal Society.

The digitisation of the Royal Society's Fellows' nomination papers offers the opportunity for further investigation of the nature of Willis's involvement in that body. Willis became a Fellow in April 1830, the year of the controversial election of the Duke of Sussex as President (Hall 1984, 57–62). Fig. 1 is a visualisation of the members whose nomination papers Willis signed, along with their other signatories – which tells us little other than that the network was large.

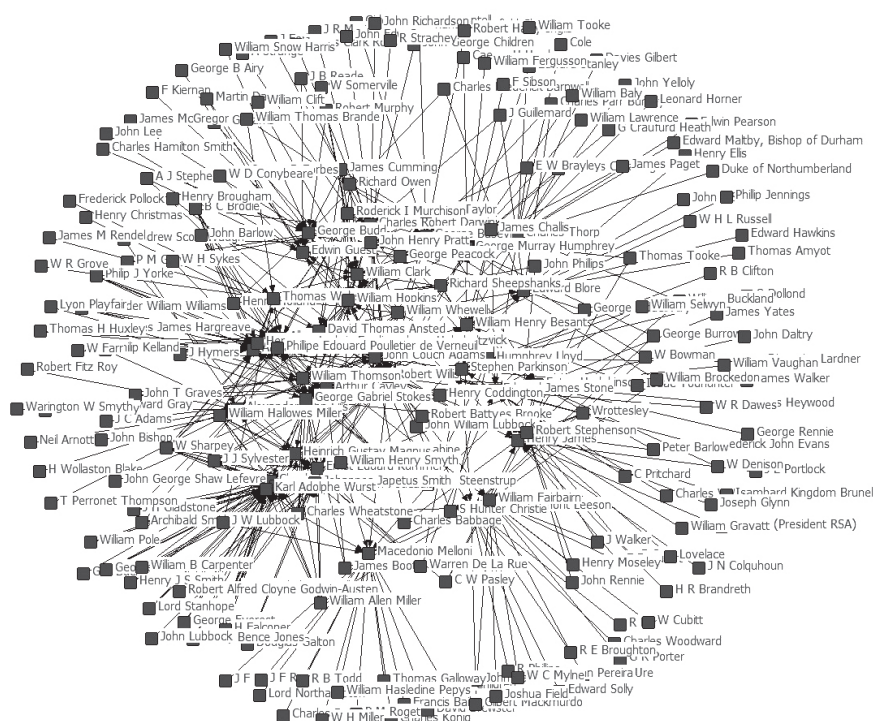


Figure 1
Visualization of signatories of Fellows' Nomination Papers signed by Willis

Reducing the numbers to look just at those he nominated and those who nominated him (Fig. 2), some patterns begin to emerge: the majority were from Cambridge, with a disproportionately high number from Caius, his original college, although still outnumbered by Trinity. Most were academic, with physics being the dominant specialism, although his other interests in engineering, architecture and philology are apparent. Although himself a scientist, his support for Blore and Basevi may suggest Willis was less purist in his attitude to Royal Society membership than Babbage, who campaigned for the election of John Herschel as President rather than the royal duke. Willis's signatures for his architectural friends predate 1847, when the election processes were reformed in order to make the Society more rigorously selective (Geike 1917, 348–9; Hall 1984, 78–82). The later nominations are predominantly foreign but analysis of international membership overall shows no rise during this period, so Willis's nominations

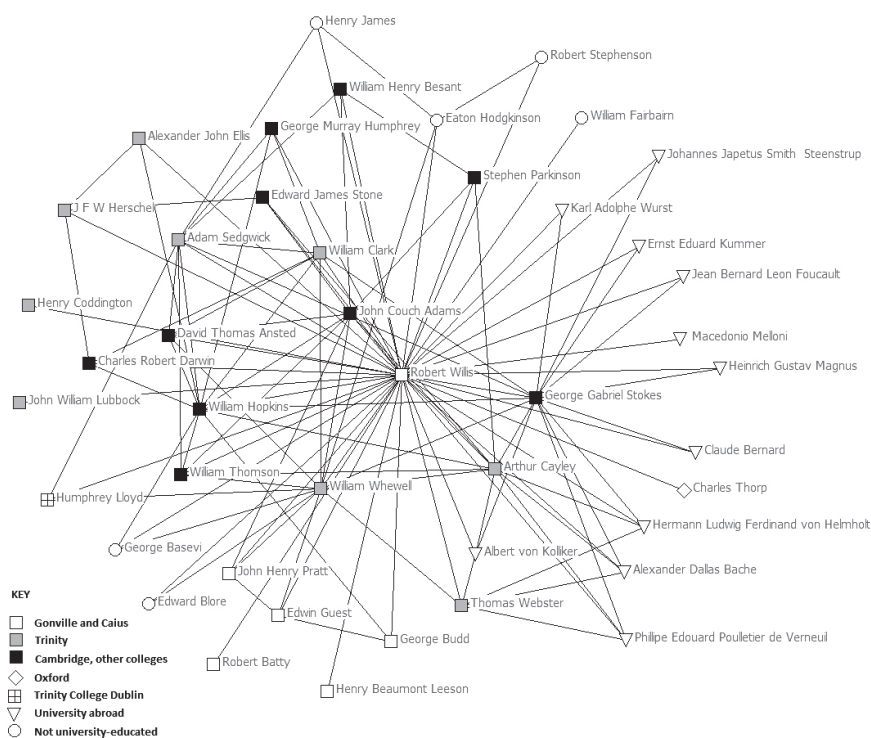


Figure 2

Visualization of those who signed Willis's papers and those whose papers he signed, showing place of education

Another way in which we can analyse this data is by looking at whose names are adjacent to Willis's in the list, based on the fact that nomination papers had to be physically passed from one signatory to the next and therefore that proximity on the paper represents proximity in reality (Fig. 3). This approach is more problematic because the papers include two lists of signatures: those who claimed personal knowledge of the candidate and those who knew him only by reputation and there is no reason to suppose that signatories could not pass to someone in

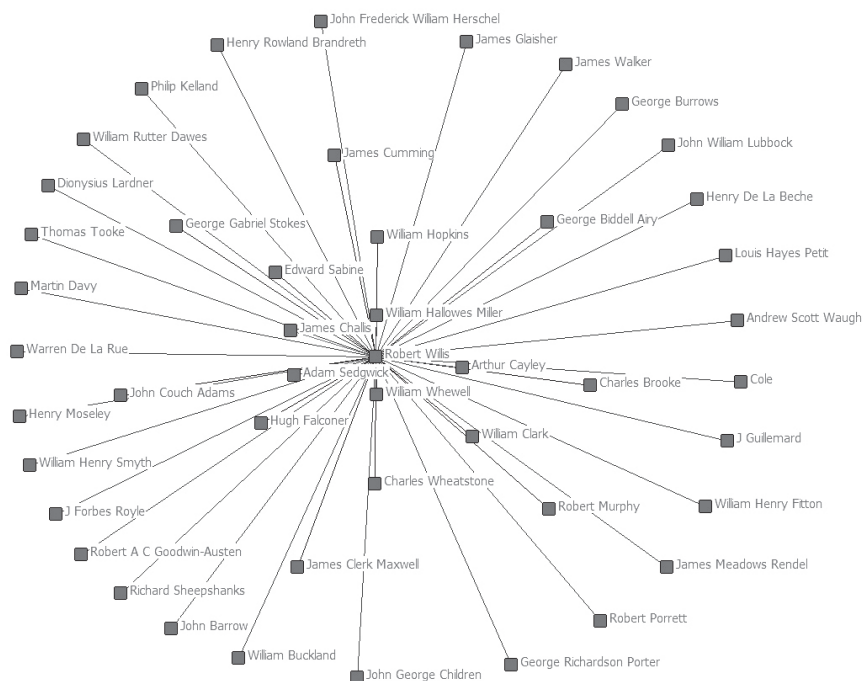


Figure 3
Visualization of adjacency data from Royal Society Nomination Papers. Proximity to Willis indicates number of times the named individual appears before or after Willis in the list of nominations (closer = higher number). Names not appearing next to Willis's have been removed

the other category rather than to the next name in their own list. However counting the number of times names are adjacent to each other adds weight to this evidence and although it should be treated with caution, some interesting findings emerge. Firstly, the visualisation suggests that the most significant figure in Willis's network was William Whewell. If we exclude W. H. Miller, with whom Willis served on the Council and where his name appears with exactly the same other signatories, all also council members, Whewell either passed papers to Willis or received them from him nearly twice as many times as the next most significant figure, Adam Sedgwick, whom we also know was a friend as well as a colleague. The importance of Whewell corresponds to the intellectual significance to Willis he has been accorded by Pevsner, Marsden and myself (Pevsner 1972; Marsden 2004; Buchanan 2013). Unsurprisingly, his brothers in law James Cumming and William Clark also recur in this adjacency data —perhaps more surprising is the number of times Willis and Charles Wheatstone exchanged papers. Although the two men addressed similar research questions in the 1820s, this is rare evidence of personal contact. Further investigation has identified that all these transactions took place when the two men were serving together on committees, both for the Royal Society and the British Association for the Advancement of Science.

In total, Willis signed the papers of forty five Fellows, although the only nomination he initiated was that of George Gabriel Stokes, with whom he collaborated on the Royal Commission on the Use of Iron in Railway Structures. This number may be compared with totals of eighty five from Babbage, seventy six from Whewell and one hundred and eleven from Charles Wheatstone. Whilst significantly higher than the election nominations by those more distanced from the Royal Society either by geography or specialisation (such as Edward Blore or William Fairbairn), these numbers suggest Willis was not a particularly active recruiter even to a body he may be assumed to have supported. Nor was he ever a member of the Royal Society Club, its dining club.

We should read too much in to what I am suggesting is restricted participation in associational activity, for others made less effort than he. For example, although older than Willis, his brother-in-law William Clark was later to join the Royal Society and neither he nor Willis's other brother-in-law James Cumming appears on the 1840 membership list of the Athenaeum. Although Whewell was elected to membership of the Royal Society's Dining Club in 1840, four years later he was deselected for non-attendance (Geike 1917, 329, 340, 348). It is also clear that Willis was prepared to play an active role in those associations to which he belonged: he served as President of the Architectural Section of the B.A.A. in 1844 and of the A.I. in 1846; of the Cambridge Antiquarian Society 1850–52; of the Cambridge Philosophical Society 1849 (as well as serving as one of the three secretaries 1836–

50); of the B.A.A.S. when it met in Cambridge in 1862 and of its Mechanical Science committee (Committee G) in 1839 and 1842. Further research needs to be done to assess the overlaps of membership between the bodies in which Willis was active and the characteristics of members, but letters suggest that he could at times be a bridge between them: when the A.I. met in Winchester in 1845, Willis had persuaded Whewell to act as President of the Architectural Section and friendship between the two men suggests he may have put forward George Peacock as President at Norwich in 1847. Both men were primarily known as scientists but their intellectual (and in Peacock's case, ecclesiastical) status would have made them valuable additions to the A.I.'s proceedings.

Man of Letters

Societies provided a formal mechanism for networking, which often overlapped with more personal networks: friendships in particular could be established and cemented through shared participation in associational activity. However the scale of congresses such as the B.A.A.S. or the A.I., which regularly attracted several hundred participants mean that further evidence is required to identify direct contacts.

One way in which scholars have identified and explored personal networks, or 'ego-nets' is through correspondence (Edwards and Crossley 2009). Epistolary networks have long been used to understand biography in a wider context: Willis's nephew, J. W. Clark, was active in saving and publishing the letters of Willis's friend, Adam Sedgwick, and several other members of the so-called Cambridge Network had contemporary or near-contemporary biographies or autobiographies published which consisted primarily of letters (e.g. Sharp, Tait and Adams-Reilly 1873; Todhunter 1876; Stair Douglas 1881; Clark and Hughes 1890; Airy 1896). There has subsequently been a long-running project to calendar the correspondence of William Whewell, whilst the Darwin Correspondence Project has brought such endeavours into the digital environment (<https://www.darwinproject.ac.uk>). Since 2009, the 'Cultures of Knowledge: Networking the Republic of Letters, 1550–1750' project has developed the 'Early Modern Letters Online' database (<http://emlo.bodleian.ox.ac.uk>) and since 2011, the 'Victorian Lives and Letters Project' has focused on the possibilities offered by the digital environment to represent the Victorian past as "an interconnected web of personal letters, diaries, journals, and notebooks" which will 'highlight the complex interaction between private lives and public personas in Victorian society' (<http://tundra.csd.sc.edu/vllc/>).

Letters and journals offer a hugely valuable resource for historians, particularly in a period when the penny post made letter-writing more accessible, its efficiency

enabled near daily interactions via post and the lack of alternatives made letters a vital means of communicating with those too distant for face-to-face conversation. It is not to devalue their potential to nevertheless urge caution, lest history be written not from the point of view of the victors but from the point of view of those whose correspondents preferred to file than to dispose of their letters. It may prioritise the perspective, or interests, of those distanced from central events (two people at the heart of things would not need to have communicated via letter) and could marginalise those whose letters do not survive (or never existed). The nature of correspondence disrupts the apparent logic of the archive —that the archive holds the papers of that archive's creator— and demonstrates that an archive is created not through authorship but through the act of consignment. An individual's archive includes those letters received from others and kept, but the letters authored by the individual will only be in that individual's archive if they remain unsent (and therefore do not perform the basic function of a letter to communicate). It is only through the creation of virtual archives that the letters sent and those received can be united to create the simulacrum of a conversation —but in most cases only one side of the conversation survives.

Letters support the significance we have attributed to associational activity and throw further light on the internal dimension of associational behaviour. In several of Willis's letters we find reference to common acquaintances, for example a letter to Babbage of 1849 that mentions Manchester contacts "our friends the Kennedys – Fairbairn – Nasmith – Whitworth – at least I believe you know them as well as I do. If not I shall be most happy to introduce you" (British Library, Add MS 37192, f.475). Equally prominent in Willis's correspondence, however, are efforts to dissociate himself from groups to which he did not want to belong. In a letter to James Orchard Halliwell, founder of the Historical Society of Sciences, Willis asked that his name be removed from the list of Council members "as I find it impossible to work for you and greatly dislike mere sinecure positions" (Edinburgh University Library, L.O.A. 16/49) whilst in a letter to Dawson Turner he wrote:

I received from you some time since a book which in accordance with your request I have forwarded to the [Cambridge] Camden Society. I ought to mention at the same time that I have withdrawn my name from that Society long since, in disgust at the tone which they have thought proper to assume in their publications, all of which are anonymous & for the most part written by men of no standing in the University. (Trinity College Library, O.14.32, no. 103).

Such comments support the earlier suggestion that he was a discriminating participant. The sense of limited involvement, fraternisation on his own terms, is

also a feature of his correspondence as a whole. This is important, because even in this period of epistolary overload, Willis's correspondence suggests that there were significant figures who may not have fully participated. Just as figures who today do not engage with social media may be rendered less visible in public discourse, so yesterday's reluctant correspondents may be rendered disproportionately less significant. There is also the equally troubling problem of archival absence. The first issue is the non-survival —or non-accessibility— of whole fonds, that is to say the archive of a single individual. To give an idea of the extent of the problem, let us return to Willis's ego-net as represented by the Royal Society nomination papers. Fig. 4 highlights those members of his network whose archives survive. Among these surviving *fonds*, only those of Blore and Adams include any letters from Willis, three letters in total.

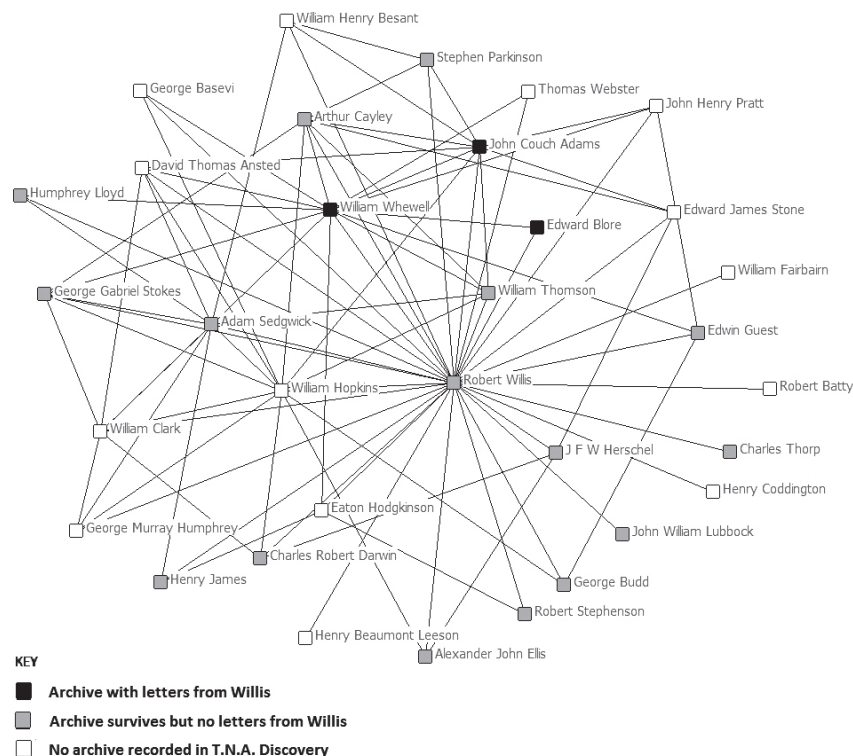


Figure 4
Visualization of those who signed Willis's papers and those whose papers he signed showing archival survival

We also need to account for the processes of appraisal and destruction which have shaped even the archives which survive. As an example, knowledge of Willis's career makes it obvious that he must have corresponded with E. A. Freeman, the historian who wrote the only obituary of Willis not penned by Willis's nephew. There is no evidence that the two men were close but Freeman succeeded in persuading Willis to lecture on Wells Cathedral to the Somerset Archaeological and Natural History Society, the only known occasion when Willis condescended to speak to any such group other than the Cambridge Antiquarian Society which he had helped to found. This must have involved an exchange of letters but although Freeman's admiration for Willis was enormous, he did not preserve their correspondence. Thus the Freeman archive preserved in the John Rylands Library, which includes 1625 letters, contains not a single epistle from Willis and there are no letters from Freeman in the Willis archive in Cambridge.¹ Other surviving archives have equally paltry remains: besides the three letters mentioned above, Charles Babbage's archive has only four letters from Willis and Darwin's has none. In the antiquarian sphere, Dawson Turner's archive has only one letter from Willis whilst the huge Nichols family archive has none. The largest cache so far found is in the archive of Charles Henry Hartshorne, a Cambridge contemporary and fellow bibliophile, who is mentioned in Romilly's diary as undertaking an "Architectural tour" with Willis (Bury and Pickles 1994, 61). Their correspondence includes just nine letters, spread over two decades, plus an additional 'stray' in a Wellcome Library collection of miscellanea (MS 8007/32/4). The reason for such limited survival is impossible to state with certainty, but examination of those letters that survive may offer some clues.

That Willis was not a prolific correspondent is suggested by a letter in his own archive, from John Stacey, curate of Worksop in Nottinghamshire asking for advice on restoration work being undertaken at his church. Stacey notes that he had written previously but had not received any response (CUL MS Add. 5141, item 8). He also apologised to Hartshorne "as usual" for not having answered his letter "with due promptitude." (Northamptonshire Record Office, HaC III E 609). In Whewell's archive are two letters using Whewell as a broker to gain access to information from Willis: in 1843, Richard Jones, the economist, wrote to Whewell about the productive power of the nation: "why do I scribble all this why I want to ask you if you think Willis would give any thought to the subject if I wrote a short paper on it and sent it to him" (Trinity College Cambridge, MS Add. C 52 78). Whether he did so is unknown, as Jones's own archive does not survive and there are no letters from Jones in Willis's papers. Similarly, in 1845, Baron Lyttelton sent plans of a chapel he was erecting to Whewell asking for his opinion and that of Willis. This could perhaps point to Willis having an aloof reputation, which might have discouraged a more direct approach; it also sup-

ports the identification of the strong link between Willis and Whewell already mentioned.

It is unsurprising that those seeking to enlist Willis's support should abase themselves: an 1849 letter from Henry Bassett of Norwich which raised concerns about restoration work at the cathedral, opened with the statement that he "must plead my excuse in addressing this epistle to you; your thorough knowledge and superior judgment of the architecture of the middle ages, and your consequent influence in these matters, are well known", and concluded, "I beg of you to pardon the great presumption of so humble an individual as myself in thus intruding my remarks upon your notice" (Norfolk Record Office MC 186/369/14–16). Nevertheless, even peers seem to have emphasised his expertise and authority: writing on the same topic, the Dean of Norwich was anxious to have Willis's "authority and kind advice" as to whether there was any order in which the replacement statues of the apostles ordered to adorn the cathedral buttresses should correctly be placed. He added, "This I fear will appear to you a ridiculous question but I am so afraid of going wrong" (Norfolk Record Office, MC 186/369/22–24).

The letters which survive suggest Willis's own correspondence style was brief and to the point. Few extend beyond a single sheet and few contain personal detail beyond the informational. The most discursive so far found are those to Hartshorne, which show evidence of mutual friendship, concern for each other's families and a shared waspish sense of humour: writing of Watkins, the incumbent of Brixworth parish church (Northamptonshire), a Saxon structure which Watkins had identified as an early Christian basilica, Willis reported "I was glad to get him out of my house as civilly and rapidly as I could... Between us we made long & short work of our interview. He was long & I was short" (Northamptonshire Record Office, HaC E 616). Dean Pellew's fears with regard to the restoration of Norwich appear well-substantiated: Watkins's work at Brixworth is described by Willis as "medling & peddling schemes", and in relation to the proposed restoration of the round church at Northampton, he wrote, "I am utterly disgusted with the wholesale sacrifice of relics of antiquity which is going on all round us under the pretence of preserving & restoring them" (Northamptonshire Record Office, HaC E 616; HaC E 615). Several letters also attest to Willis's busy-ness, his perception (whether justified or not) that he was over-committed and could not take on further responsibilities (Northamptonshire Record Office, HaC E 615; HaC III E 616; Wellcome Library, MS 8007/32/3).

Finally, we have evidence that Willis was secretive and disinclined to share his research prior to public announcement via lecture or publication. In an 1841 letter to Hartshorne, he writes of a book he had ordered from Bohn's catalogue which had turned out to be even more valuable than expected but "what that is and why so to me inestimable is too mysterious a matter to trust to paper but I

will whisper it in your ear when you come to Cambridge.” (Northamptonshire Record Office, HaC III E 608). Another of his closest collaborators was David James Stewart, Canon of Ely, with whom he worked at that cathedral and who collected architectural evidence for him. In 1852, Willis asked Stewart for information about continuous masonry coursing in Early English masonry versus discontinuous courses in Decorated work, which he considered to be a new discovery. Tellingly he added: “& keep the secret to yourself” (Cambridge University Library, MS EDC 14/37/2). This suggests that, in contrast to many of his peers, for whom scholarship was a collaborative project, with letters serving as a means of sharing data, discussing methods and results, and building a research community, Willis was a loner, who shared his ideas with few and reached conclusions on his own. If so, we might conclude that even those to whom Willis may have written might not have bothered to save his letters because their content was limited, with little long-term value.

The survival of letters in Willis's own archive is both patchy and unsystematic, so cannot be used to construct a comprehensive picture of his personal network. It has a total of sixty one correspondents, including names which might otherwise have been unidentified as contacts, such as Joseph Burt of the Public Record Office. Nevertheless, it does offer some interesting clues to his personal relationships. Without the letters, it might not have been possible to identify what were evidently three significant collaborations: with D. J. Stewart, Arthur Rigg of Chester, and his brother-in-law, Charles Humfrey. In all these cases a similar form of relationship emerges: although in each case participating in a shared project (data collection, educational model-making and patenting a letter-balance respectively), Stewart, Rigg and Humfrey present themselves as subordinate to Willis through flattering, offering assistance or seeking approval. This corresponds with what we know of Willis from other sources: for example, in 1848, Charles Cardale Babington, a fellow founder of the Cambridge Antiquarian Society, made an excursion with the Rev. John James Smith, Augustus Wollaston Franks, Frederick Townsend and Lukis (unidentified member of the Lukis family of Guernsey, possibly William Collings Lukis) to Bottisham (Cambridgeshire) where they “spent some hours in the careful examination of the church, under Willis's direction” (Babington 1897, 147). Although Smith and Babington were near contemporaries of Willis, and Babington had dined with him several times, the relationship is clearly presented as asymmetrical. Thus Willis's letters seem to corroborate the view, gained from looking at his associational activity, that his participation was limited and very much on his terms. Let us now turn to look at how he managed the relationships in which he had less choice —his family ties— and consider what these can tell us about how the cultural capital acquired through social networking could be passed on.

Family

Although voluntary associations have been identified as particularly significant to nineteenth-century knowledge creation, genealogical ties have also been linked to intellectual networks. Perhaps the most-cited article on social network analysis *avant la lettre* is Noel Annan's 'The Intellectual Aristocracy' of 1955, which used the ties of blood or marriage to present a picture of a close-knit elite encompassing many of the individuals Willis would have known (Annan 1999). The nature of that elite is not defined, simply presented as self-evident through enumeration of the positions held (with an emphasis on Oxbridge status, literary production and public service). Nevertheless its gentrified character is implied through the fox-hunting metaphor which holds the argument together. That readers were evidently expected to understand and accept such a metaphor anticipates their shared membership of this elite—and consequent disinclination to challenge its existence. Yet its evidential basis is undeniably weak—rather than starting by defining the elite and then assessing the characteristics of its members, including their ties of kinship, a network is constructed which is then taken as the elite in its totality.

William Whyte and William C. Lubenow have offered a definition which looks to a shared culture, rather than common genealogy, but retains the focus on those who were indubitably part of the elite as (un)defined by Annan and connects its emergence with Oxbridge reform (Whyte 2005; Lubenow 2010 and 2015). Willis himself died too early to play a personal role in the world they describe (despite the date range, Lubenow's focus is on the latter part of the nineteenth century) but the choices he provided for his children helped to establish the terms of their involvement (or not). Willis's descendants shared the same blood and all could access the same culture, although the extent to which they participated is unrecorded but, as will be shown, Oxbridge attendance, so important to Annan, Whyte and Lubenow, was limited. Willis's family were not 'philistines', nor were they excluded from the intellectual aristocracy through class or religion. Which of them should be included, however, is a question on which the definition of the intelligentsia depends and much else besides, for many arguments about Britain's industrial 'decline' have focused on existence, or not, of an anti-industrial or anti-entrepreneurial bias in British culture (Wiener [1981] 2004; Dintenfass 1992; Edgerton 1996). Such bias is evident in Annan's account, where it may be noted that many of his examples are defined as 'Quakers' rather than 'businessmen', even when the latter label would have fitted equally well, but we should take care not to project this backwards onto career choices made in the nineteenth century. The story of Willis's kinship network therefore provides a case study of how boundaries

have been constructed between intellectuals and technological elites, as much by historians as by contemporaries.

If we accept the existence of an intellectual aristocracy in the second half of the nineteenth century, Willis was undoubtedly a member, though his introduction into the caste originally depended less on intellect than on the eighteenth-century system of privilege and placement. His grandfather's treatment of George III enabled him to secure sinecures for all but one of his sons, who had a disability—but only three of them had offspring (Fig. 5). All the grandsons went to Oxbridge, after which two went into medicine, Willis pursued an academic career and the rest went into the Church. There is no evidence that Willis maintained contact with any of his cousins and further probing may help to suggest why. The three boys closest to his age were clergymen, but the Rev. John Willis (1799–1855, son of Thomas) seems to have been married to an alcoholic, ran into financial difficulties and was found guilty of being drunk in the pulpit and visiting a brothel, whilst the Rev. Richard Child Willis (1799–1877, son of Richard) was convicted of fraud, spent a year inside, then, whilst still married, cohabited with a woman less than half his age, whom he claimed was the widow of his non-existent son but who is described as his wife in the 1861 census, all this whilst his actual wife was living with her brother (Adams n.d.). The Rev. Thomas Willis (1801–1857, son of Thomas) who, unlike the others, studied at Cambridge, seems to have been more respectable so we know less about his activities, but nevertheless there is no evidence of any connection with his cousin Robert.

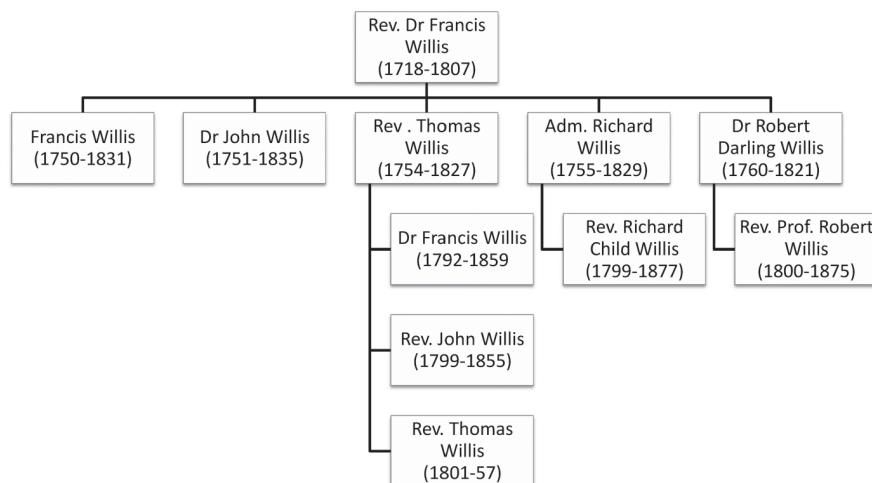


Figure 5
Sons and grandsons of the Rev. Dr Francis Willis

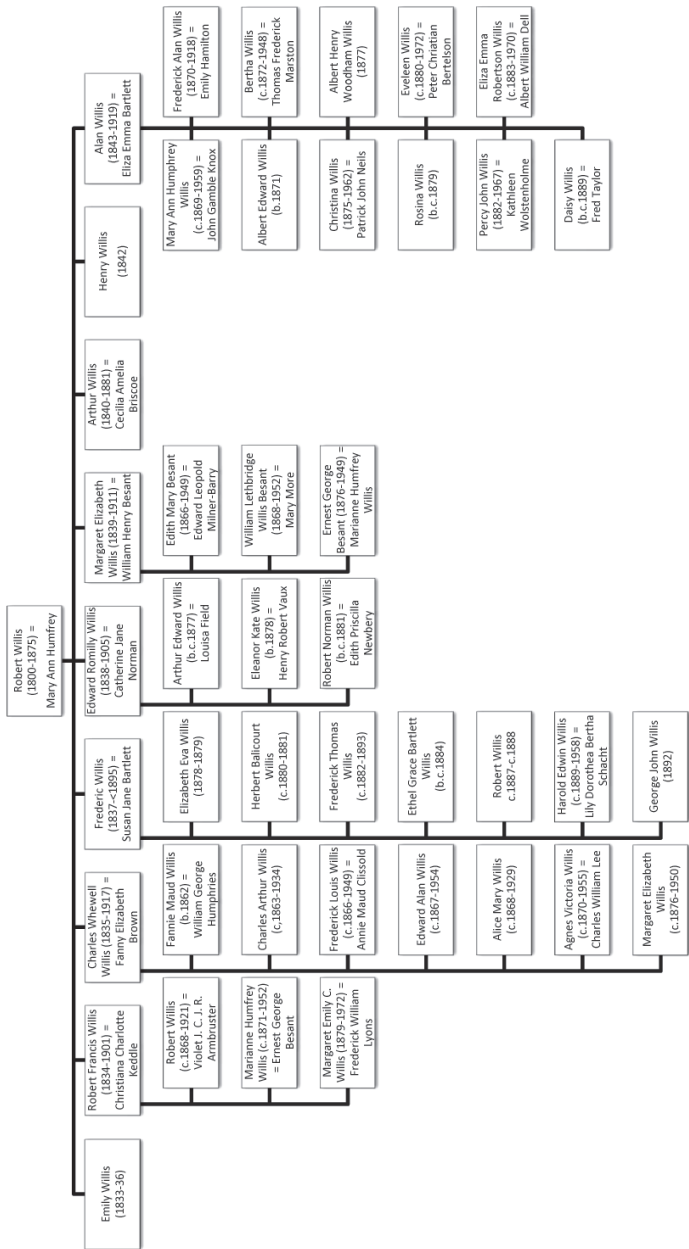


Figure 6
Children and grandchildren of Robert Willis

Willis's own descendants (Fig. 6) had their share of irregularities (at least two cohabited before marriage, according to their census returns) but the reason for their general exclusion from the intellectual aristocracy as represented by Annan seems to depend more on their educational than their ethical path. We do not know when or why Willis fell out with his eldest son, Robert Francis, who attended Cambridge but failed to shine and eventually entered the Church, where he had an equally undistinguished career. However his offspring fit the model of an intellectual elite: his son became a diplomat, his elder daughter married one of her Besant cousins and the daughter of his younger daughter (who was married in Cambridge by another of the Besants) became a respected Arthurian scholar.² Willis's only surviving daughter Margaret fits the pattern even more closely: she married Cambridge mathematics coach William Henry Besant and produced three children with impeccably Cantabrigian credentials, whose children in turn maintained their status.

By contrast, Willis's younger sons followed a very different educational trajectory. Aside from Frederic and Arthur, for whom Willis purchased a passage to New Zealand and a farm for when they arrived (Adams, n.d.), Charles, Edward and Alan all pursued their father's scientific pathway and none studied at Cambridge.³ Charles became a mechanical engineer in London—he was a member of the Institute of Mechanical Engineers but was not accorded an obituary. He lived at various addresses in London, before dying as a man of independent means in Peckham. He had seven children but none of his sons is recorded as anything more than a clerk. Edward became a civil and mechanical engineer through pupillage with William Fairbairn and James Brunlees and worked both at the Landore Steel Works in Swansea and on the Sao Paulo Railway in Brazil (information from his election papers to the Institute of Civil Engineers). Willis probably set up this pupillage for he knew Fairbairn well. He became a member of the Institute of Civil Engineers but, again, did not merit an obituary. Of his three children, his sons are recorded on the 1911 census as sewing machine and typewriter salesmen. Finally, Arthur attended the Royal School of Mines and became an industrial chemist at the Landore Steel Works in Swansea. He was accorded an obituary in the *Journal of the Chemical Society* for his original research, but it was claimed that work commitments and ill-health prevented him from publishing much and he died young in 1881, married but without children.

Although we cannot draw wider conclusions from an individual family's history, it is notable that of Willis's descendants, only those who retained a Cambridge connection held the sorts of academic and public service roles which characterise both Annan's intellectual aristocracy and Lubenow's liberal intellectuals. The three engineers seem to have had adequate intellect, joined professional bodies and, especially Arthur, aspired to making a scholarly contribution, but their physical loca-

tions, choice of wives and the direction of their studies were not congenial to an insider status based on literary endeavour and metropolitan activity. In contrast to Lubenow, who includes ‘liberal’ professionals as part of his elite, T. W. Heyck identified the drive for professionalization as an anti-liberal principle (Heyck 1982, 107). We cannot answer the question of whether he could have been aware that by excluding his sons from Oxbridge, he was also excluding them from what otherwise might have been their birthright and, if so, whether his choice was a considered one. By all accounts a fond—indeed according to Romilly an over-fond—father (Bury and Pickles 2000, 265), it seems unlikely that he was deliberately alienating his offspring. Was he rejecting Cambridge and liberal values, or demonstrating preference for more vocational or professional training? As I have argued elsewhere, his own support for the Royal School of Mines suggests that he rated this institution highly and anticipated it would “turn out men of ability and acquirements equal in their own line to the great abstract philosophers of Cambridge & Oxford in theirs” (T.N.A., PRO 30/29/23/14). Perhaps he hoped his younger sons would attain “lucrative appointments from the government”, which might have greater public benefit than his eldest son’s role in the Church. With only circumstantial evidence for his motivation or theirs, we can but speculate—but their choice does not fit with a characterisation of a mid nineteenth-century intellectual culture as one which invariably devalued industrial science and practical expertise in favour of ‘nobler callings’ as has been suggested (Mayer [1981] 2010, 259).

If there is little evidence that Willis maintained connections with his father’s family, there is more that he built relationships with his in-laws, the Humfreys. Here too the family’s trajectory was away from Cambridge, breaking an existing link. The earliest evidence we have for a connection between the two families is in 1825, when Charles Humfrey, his future father-in-law, is named as a trustee of the fund established by Willis’s father to support his children and their mother (T.N.A., C 13/368/25). It is possible that Humfrey may have known Willis senior from his time as a pupil of London architect James Wyatt, but it is more likely that his role derived from his status as a banker in Cambridge. Humfrey was a successful local businessman—his father had been a carpenter, born in Norwich, whose father died young and who may have moved to Cambridge to benefit from family connections with the University (Fig. 7). These came via the descendants of his great uncle, Richard Humfrey, who seems to have taken responsibility for the widow and child of his brother. Richard Humfrey I was a wealthy worsted weaver with substantial property holdings in Norwich and in his will left his sister-in-law a number of properties in the Coslany district, as well as money to his nephew Charles and his two nieces (T.N.A., PROB 11/921/66). His will suggests he was a devout churchman and his son, Richard II, having studied at Corpus Christi College was ordained and served for many years as rector of Thorpe near

Norwich (Venn 1922–54). His son, Richard III, also studied at Corpus and was ordained (Venn 1922–54). He became tutor to the Royal Princes and was so esteemed by King George III that is said to have exclaimed “I can easily procure another tutor for the princes, but I shall never meet with another Humfrey”. This Richard, however, predeceased his father in 1780. His brother, John, became rector of Wroxham, near Great Yarmouth, where he built himself a mansion —possibly designed by Humfrey— on the proceeds of three livings and an inheritance via his wife (Venn 1922–54). He was also a prebendary of Lincoln (providing another possible link with the Willises) but died without issue. His heir was one Robert Blake, who inherited the estate on the condition that he changed his name to Blake-Humfrey. The only connection I have so far been able to find between Blake and Humfrey is via Blake’s wife, Charlotte, who was the youngest daughter of Lieutenant-Colonel John Harvey of Thorpe Lodge. The Thorpe link seems fairly tenuous, however, and it is interesting that a non-relative was prioritised over the Humfreys of Cambridge, although they did receive financial bequests (T.N.A. PROB 11/2062/137).

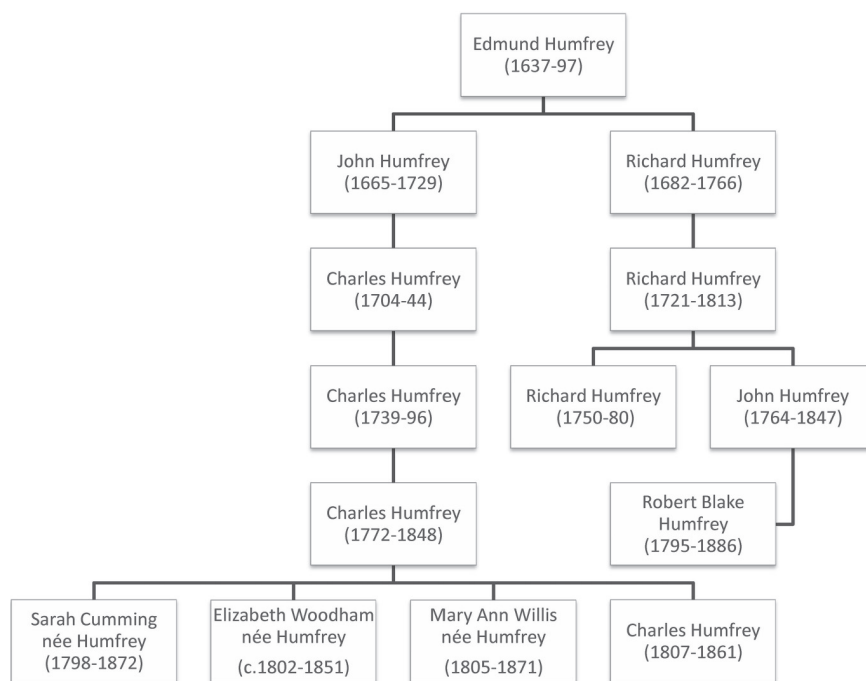


Figure 7
Humfrey family tree

Charles Humfrey could be portrayed as an architect on the make, but his family could boast a long landed lineage and their own heraldry. The careers of his children fit with this respectability. His only surviving son, Charles, attended Caius a few years after Willis and moved with him to Downing (Venn 1922–54), and all his daughters married dons. The eldest, Sarah, married James Cumming, Professor of Chemistry; the youngest, Mary Ann, married Willis, and the middle sister, Elizabeth, looked after her parents until their deaths, then married the much younger Henry Annesley Woodham, a Fellow of Jesus. Cumming, as the senior son-in-law, seems to have been the closest to Humfrey. He took a significant role in local politics and served as a magistrate. Like his father-in-law, he was strongly Whig. Cumming and Sarah had three surviving children, their son going into the Church. The elder daughter married a man of property and became interested in spiritualism (Myers 1903, 35–7), the younger married a clergyman with Cambridge connections. Chemistry became a significant strand linking the Humfrey siblings and their offspring—in older age, Mary Ann started her own chemistry experiments in pursuit of creating a purer soap, undertaken in a wash-house cum laboratory Willis had constructed for her in the garden of their house on Parker's Piece (Willis 1868, 1869 and 1871).

Cumming seems to have left no papers (Brock 2005, 141), so we have little evidence to work with but there are some clues that the Cumming and Willis families were close. Cumming officiated at their wedding in what had become the Willis family's London church, St Mary-le-Bone. The link between the two families probably also explains Willis's decision to move his sons from Marlborough College to King William's College on the Isle of Man, whose Vice-Principal from 1841, Joseph Cumming, was James Cumming's nephew and therefore the boys' second cousin.⁴ Willis and his brother-in-law Charles Humfrey (Fig. 8) also seem to have maintained a close connection and it was Charles who travelled to Birmingham to try to put Willis's patent letter balance into production in 1840. Although after graduation, Charles nominally joined his father in the banking business, his interests were evidently more practical. In 1839 or 1840 he joined an oil, candle and soap manufactory in Hatcham, trading under the name E. Manning and Company. He lived in south London and on the 1851 census is listed as a candle manufacturer in Deptford. He died bankrupt in 1861, in which year his son Charles V is described as an oil refiner in Newington, South London, employing two hands. Both men appear as innovators, applying for patents for improvements to their processes (Museum of the Scottish Shale Oil Industry). One of them was a partner in the firm of Humfrey, Yooll & Co. who operated a refinery at Suffolk-grove, Southwark which processed imported Canadian crude oil. The works appear to have closed following outcry over the obnoxious fumes produced by the process. It was possibly after this closure that Charles V

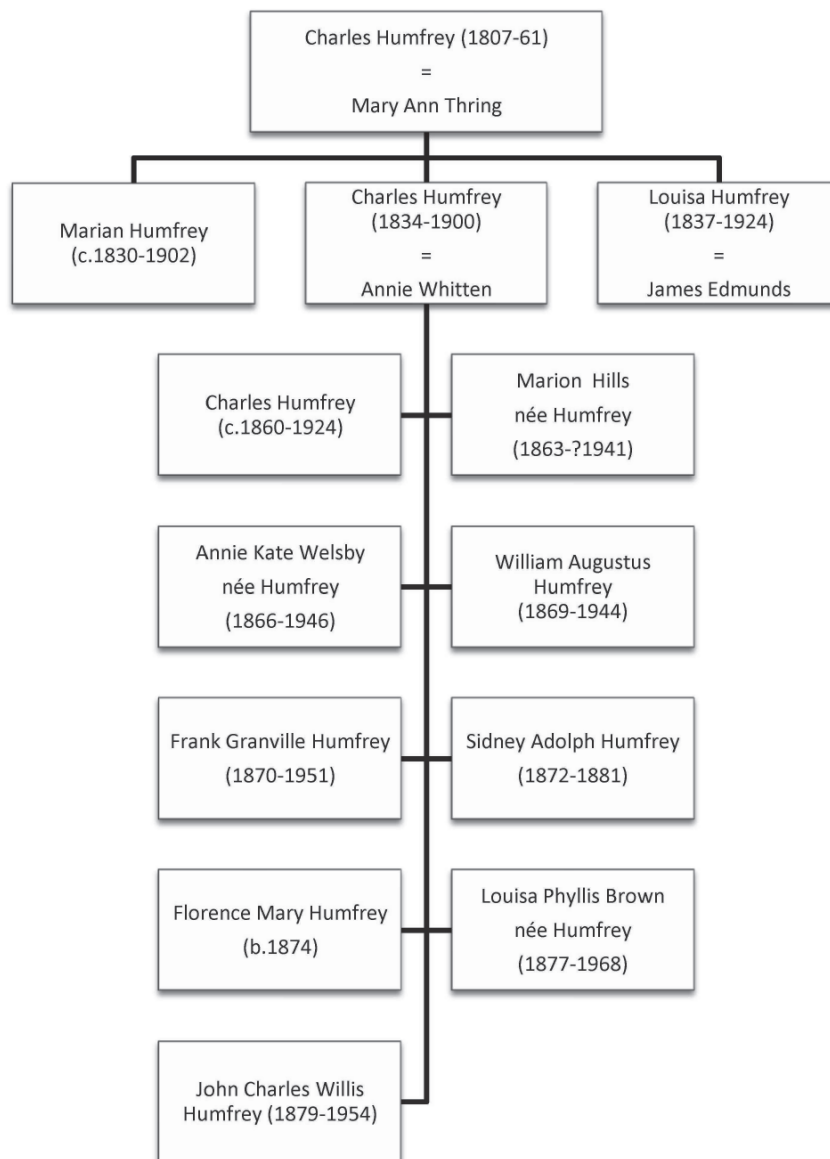


Figure 8
Family tree of Charles Humfrey, brother-in-law of Robert Willis

moved north to Cheshire, where he became a manager at the Saltney Oil works on the banks of the River Dee. There he was involved both in refining oil and extraction of shale gas. According to the 1881 Census he was his own boss in an oil manufacturing business employing 78 men, and from 1882–1890 he was manager of an alkali works at Northwich, Cheshire (Society of Chemical Industry membership lists). After his retirement he described himself as a manufacturing chemist, emphasising the scientific, rather than the mercantile nature of his career (1891 Census). He was a member of the Society of Chemical Industry, as was his eldest son Charles, who also managed alkali works in Cheshire.

Evidence for an ongoing connection with the Willis branch of the family is offered by Charles V's youngest son, who was named John Charles Willis Humfrey. He studied engineering at the University of Liverpool and then went on to study as an advanced student at St John's College, Cambridge. He became a metallurgist at the National Physical Laboratory, then worked as a metallurgist in the Admiralty Inspection Office during the First World War and went on to work for Sandberg's, an engineering company, where he invented the Willis-Sandberg freewheel clutch. He was awarded the O.B.E. in 1920 (Venn 1922–54). The link with Cambridge was evidently not automatic, suggesting that like the younger Willises, the Humfrey family had lost their Cambridge affiliation, through geographical distance and attachment to practical science—but having reconnected, J. C. W. Humfrey might be considered an intellectual aristocrat, with his public position and honour from the State.

Albeit limited, the example of Willis's family confirms the significance of the professions to nineteenth-century intellectual culture—for Willis, engineering seems to have held no inferior role to the Church as an occupation for his sons. Until the later nineteenth century, however, Oxbridge played little role in technical vocational education: to become engineers, Willis's sons had to eschew a University education, whilst half a century later, his great-nephew used it as an entry to a public position. Yet an academic education seems to have remained a key component in transmitting cultural capital and the occupational divide between those of the second generation with close Cambridge links and those without is readily apparent.

Conclusion

What can the patterns identified through studying Willis's networks tell us? Firstly, there is insufficient evidence to be able to use networks as a key to understanding his intellectual development, although the more systematic approach taken here seems to corroborate patterns already identified. Compared with the data available from citations within his publications, however, which attest to his

voracious reading, information about personal contacts is very limited. The poverty of data is partly the result of absence of evidence but there does also seem to be evidence of absence: that compared with some contemporaries, Willis was not heavily involved in networking activity and that had more letters survived, they might not have offered the richly personal, reflective and discursive resources found in other nineteenth-century correspondence. This is, of course, a risky statement which has to remain provisional.

Secondly, in terms of input, Willis belonged to more scientific bodies than he did antiquarian and architectural and these were more bureaucratic, with meetings of councils and committees in which Willis played an active role and which took up time. He was able to devote such time to the work because he had an independent income: the lower levels of participation by his brothers-in-law Cumming and Clark may relate to their parallel lives as Anglican clergymen. Nevertheless, Willis's correspondence suggests a level of over-commitment which may help to explain why many of his architectural papers remained unpublished.

Thirdly, from taking an overview of Willis's role within the networks with which he was involved, it seems apparent that he was only occasionally active as an interface between different parts of a network as a connector. That he had the potential to perform such a role is clear, particularly in engineering, where he had working relationships with both 'practical men' and academia, yet contributions deriving from this position seem relatively minor: offering a chapter to Barlow (1851), introducing William Hopkins to William Fairbairn, or encouraging Gabriel Stokes to teach at the Metropolitan School of Science. It is also only in science that he played a more ambassadorial or advocacy role: other than his keynote lecture, reports of A.I. Congress Proceedings reveal little input from Willis. The interests of his children and wife may also suggest that the topics most frequently discussed at home were scientific rather than architectural, for unlike the antiquarian dynasties spawned by Dawson Turner, Hartshorne and Albert Way, none of his direct descendants is known to have shared his antiquarian interests.

Finally, might the limited nature of his social participation in antiquarian networks help us to understand why his contribution, whilst demonstrably substantial, did not result in the establishment of architectural history as a formal discipline in Britain and why he had so few direct disciples? Most of the architectural historians working in early twentieth-century France trace a lineage back to Jules Quicherat or Viollet-le-Duc, yet none of those working in England at the same time had any personal connection with Willis. Whilst structural differences do play a part — Britain had fewer paid roles for architectural historians and therefore less support for their education than in France or Germany — but as I have suggested elsewhere, a more charismatic man, or one who was less of a loner than Willis, might have engineered opportunities to spread his influence. Such

circumstances were not impossible to achieve: at the Architectural Association, Edmund Sharpe's sketching club trained innumerable young architects in methods closely akin to Willis's and familiarised them with Willis's ideas. In the late 1840s, when he ran a series of lectures at the Royal Institution, paralleled at Cambridge, it might have appeared that Willis would establish both a popular and an academic programme of education in architectural history. But by 1850, his attention was called elsewhere—to the experiments on iron structures for the Royal Commission, to the Great Exhibition and subsequently to the Metropolitan School of Science and to his efforts to improve engineering education. Here too it might be argued that his unwillingness to enter into controversy and his lack of leadership were obstacles to achieving his aims—but more significantly, it led to a slowing down of architectural activity. By the 1860s, when his participation in the A.I. began to increase once again, he had become a 'grand old man' and perhaps the moment for new initiatives had passed. As he wrote in 1868 to an unknown correspondent who had apparently suggested he should undertake a study of Bath Abbey, "I can only repeat the old story, namely that I have my time completely filled up with the work of completing investigations voluntarily undertaken years ago & am compelled to decline new ones" (Wellcome Library, MS 8007/32/3).

Acknowledgements

I would like to thank the archivists of the repositories named below, as well as those of King's College London; the Honourable Society of Gray's Inn; Imperial College London; the Royal Institution, London; the Royal Society of Arts; Trinity College Dublin, and University College London for providing access to their holdings, answering enquiries, and providing copies of material. I would also like to thank Chris Adams for providing further information about the Willis family; Gerrylynn Roberts of the Open University for providing information from the Open University's Chemists' Database, and Elisa Bellotti, Martin Everett and Nick Crossley of the University of Manchester for providing training in the use of Ucinet, used for some of the visualisations.

Notes

1. Dade-Robinson 2015, 173 footnote 63 is incorrect.
2. The four children shown on the Willis Family Tree in Buchanan 2013 is incorrect: one of the daughters was known by two different names.
3. This information is a correction of Buchanan 2013, 223.
4. Not Cumming's cousin as previously identified: Buchanan 2013, 223, footnote 9.

Primary Sources

Bodleian Library: J.H. Parker Papers; Harcourt Papers.
 British Library: Charles Babbage Correspondence
 Cambridge University Library: Adam Sedgwick Papers; Edward Blore Papers; Ely Dean and Chapter Archive; George Gabriel Stokes Papers; Robert Willis Papers.
 Geological Society: Nomination Papers
 Edinburgh University Library: James Orchard Halliwell-Phillipps Papers.
 Institution of Civil Engineers Archive: Nomination papers.
 Liverpool University Library: Moor Autograph Letters, GB 141 Moor/524.
 Norfolk Record Office: A. B. Whittingham Papers.
 Northamptonshire Record Office: Charles Hartshorne Papers.
 Royal Society Archives: Nomination Papers.
 St Andrews University Library: J. D. Forbes Papers.
 St John's College, Cambridge: John Couch Adams Papers.
 Society of Antiquaries of London Library: Albert Way Papers.
 The National Archives (T.N.A.): C 13/368/25; PRO 30/29/23/14; PCC Wills.
 Trinity College, Cambridge Library: Dawson Turner Papers; William Whewell Papers.
 Wellcome Institute for the History of Medicine Library: MS 8007.

Bibliography

- Adams, C. n.d. The Willis Family of Lincolnshire. Available at <http://chradams.co.uk/willis/contents.html>. <Accessed 01/07/2016>.
- Airy, W., ed. 1896., *Autobiography of Sir George Biddell Airy*. Cambridge.
- Anderson, R. D. 1995. *Universities and Elites in Britain since 1800*. Vol. 16. Cambridge.
- Annan, N. 1955. The Intellectual Aristocracy. In N. Annan. 1999. *The Dons: mentors, eccentrics and geniuses*, 304–41. London.
- Athenaeum. 1840. *Rules and Regulations for the Government of the Athenaeum*. London.
- Babington, A. M. ed. 1897. *Memorials, Journal and Botanical Correspondence of Charles Cardale Babington*. Cambridge.
- Barlow, P. 1851. *A Treatise on the Strength of Timber, Cast and Malleable Iron and Other Materials*. New ed. London.
- Borgatti, S. P.; M. G. Everett and L. C. Freeman. 2002. Ucinet for Windows: Software for social network analysis. Harvard, MA. Analytic Technologies.
- Brock, W. 2005. Coming and going: the fitful career of James Cumming. In: *The 1702 Chair of Chemistry at Cambridge: Transformation and Change*, edited by M. D. Archer and C. D. Haley, 138–65. Cambridge.
- Buchanan, A. C. 2013. *Robert Willis and the Foundation of Architectural History*. Woodbridge.
- Bury, M. E. and J. D. Pickles eds. 1994. *Romilly's Cambridge Diary 1842–1847*. Cambridge.
- Bury, M. E. and J. D. Pickles eds. 2000. *Romilly's Cambridge Diary 1848–1864*. Cambridge.

- Clark, J. W. and T. M. Hughes eds. 1890. *The Life and Letters of the Reverend Adam Sedgwick*. 2 vols. Cambridge.
- Clark, P. 2000. *British Clubs and Societies, 1580–1800: The Origins of an Associational World*. Oxford.
- Collini, S. 2006. *Absent Minds: Intellectuals in Britain*. Oxford.
- Dade-Robinson, C. 2015. Architecture as Evidence: E. A. Freeman and Harold's Church. In *Making History: Edward Augustus Freeman and Victorian Cultural Politics*, edited by G. A. Bremner and J. Conlin. Oxford.
- Dintenfass, M. 1992. *The Decline of Industrial Britain 1870–1980*. London and New York.
- Edgerton, D. 1996. *Science, technology and the British industrial 'decline', 1870–1970*. Cambridge.
- Edwards, G. and N. Crossley. 2009. Measures and meanings: Exploring the ego-net of Helen Kirkpatrick Watts, militant suffragette. *Methodological Innovations Online*. 4(1): 37–61.
- Elliott, P. 2003. The origins of the 'creative class': provincial urban society, scientific culture and socio-political marginality in Britain in the eighteenth and nineteenth centuries. *Social History*. 28(3): 361–387.
- Geike, A. 1917. *Annals of the Royal Society Club*. London.
- Grafton, A. 2009. *Worlds Made by Words: Scholars and Community in the Modern West*. Cambridge, Mass.
- Hall, M.B. 1984. *All Scientists Now: The Royal Society in the Nineteenth century*. Cambridge.
- Heyck, T. W. 1982. *The Transformation of Intellectual Life in Victorian England*. London and Canberra.
- Lubenow, W. C. 2010. *Liberals Intellectuals and Public Culture in Modern Britain, 1815–1914. Making Words Flesh*. Woodbridge.
- Lubenow, W. C. 2015. "Only Connect": *Learned Societies in Nineteenth-Century Britain*. Woodbridge.
- McLean, P.D. 2007. *The Art of the Network: Strategic interaction and patronage in renaissance Florence*. Durham, NC.
- MacLeod, R. and Moseley, R. 1980. The 'Naturals' and Victorian Cambridge: reflections on the anatomy of an elite, 1851–1914. *Oxford Review of Education*. 6(2): 177–195.
- Marsden, B. 2004. 'The progeny of these two "Fellows"': Robert Willis, William Whewell and the sciences of mechanism, mechanics and machinery in early Victorian Britain. *British Journal for the History of Science*. 37(4): 401–434.
- Mayer, A. J. [1981] 2010. *The Persistence of the Old Regime: Europe to the Great War*. London and Brooklyn, NY.
- Mische, A. 2003. Cross-talk in movements: Reconceiving the culture-network link. In *Social movements and networks: Relational approaches to collective action*, edited by M. Diani and D. McAdam, 258–80. Oxford.
- Museum of the Scottish Shale Oil Industry. Charles Humfrey & Son. http://www.scottish-shale.co.uk/GazBeyond/BSEnglandShale/BSES_Companies/Humfrey&Son.html. <Accessed 01/07/2016>.

- Myers, F. W. H. 1903. *Human Personality and its Survival of Bodily Death*. 2 vols. London.
- Rowe, D. E. 2003. Mathematical Schools, Communities, and Networks. *The Cambridge History of Science*. 4. Cambridge.
- Pevsner, N. 1972. *Architectural Writers of the Nineteenth Century*. Oxford.
- Sanderson, M. ed. 1973. *The Universities and British Industry 1850–1970*. London and Boston.
- Shairp, J. C.; P. G. Tait and A. Adams-Reilly. 1873. *Life and Letters of James David Forbes, F.R.S.* London.
- Stair Douglas, J. M. 1881. *The Life and Selections from the Correspondence of William Whewell DD*. London.
- Todhunter, I. 1876. *William Whewell: An Account of His Writings, with Selections from His Literary and Scientific Correspondence*. 2 vols. London.
- Venn, J. 1922–54. *Alumni Cantabrigienses. students, graduates and holders of office at the University of Cambridge, from the earliest times to 1900*. Cambridge.
- Whyte, W. 2005. The intellectual aristocracy revisited. *Journal of Victorian Culture* 10(1): 15–45.
- Wiener, M. J. [1981] 2004. *English culture and the decline of the industrial spirit, 1850–1980*. 2nd ed. Cambridge.
- Willis, M. A. 1868. *A Short Sketch about Washing Linen, and How I Learnt the Modern Art*. Cambridge.
- Willis, M. A. 1869. *Science Applied to the Washing of Linen, and to its Effects upon Health*. London.
- Willis, M. A. 1871 *A Short Essay on Practical Experimental Philosophy, its Use and Abuse*. London.

